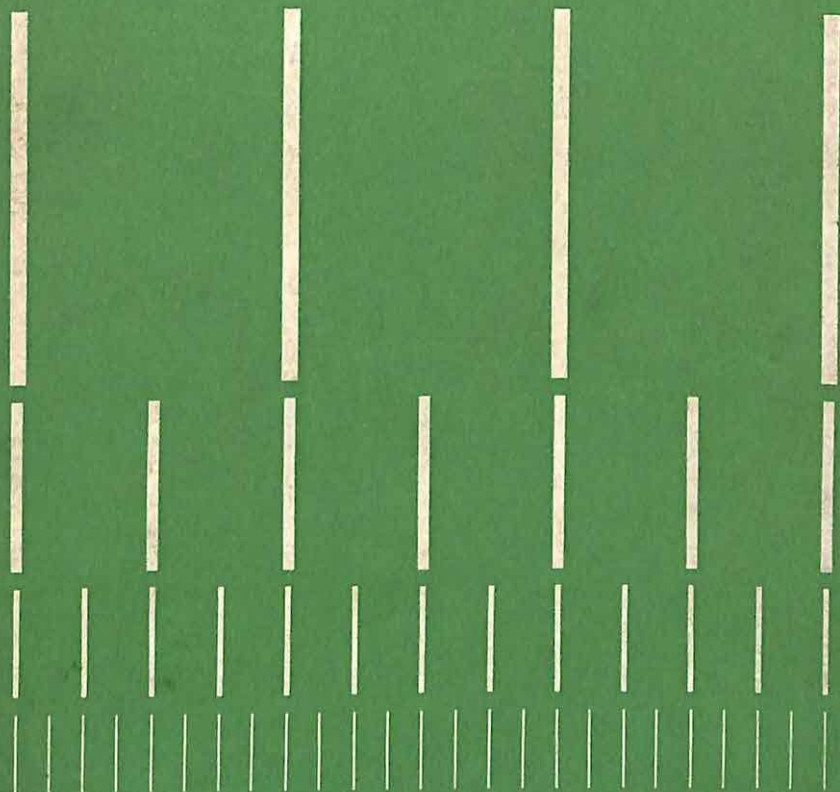


Planning the school curriculum

Arich Lewy



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Fundamentals of educational planning—23

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Arieh Lewy



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Fundamentals of educational planning

The booklets in this series are written primarily for two types of clientele: those engaged in—or preparing for—educational planning and administration, especially in developing countries; and others, less specialized, such as senior government officials and policy-makers who seek a more general understanding of educational planning and of how it is related to overall national development. They are devised to be of use either for private study or in formal training programmes.

Since this series was launched in 1967 the practice as well as the concept of educational planning has undergone substantial change. Many of the assumptions which underlay earlier attempts to put some rationality into the process of educational development have been abandoned or at the very least criticized. At the same time, the scope of educational planning itself has been broadened. In addition to the formal system of schools, it now includes other important educational efforts in non-formal settings and among adults. Attention to the growth and expansion of educational systems is being supplemented and sometimes even replaced by a growing concern for the distribution of educational opportunities and benefits across different regions and across social, ethnic and sex groups. The planning, implementation and evaluation of innovations and reforms in the content and substance of education is becoming at least as important a preoccupation of educational planners and administrators as the forecasting of the size of the educational system and its output. Moreover, the planning process itself is changing, giving more attention to the implementation and evaluation of plans

as well as to their design, and exploring such possibilities as integrated planning, participatory planning, and micro-planning.

One of the purposes of these booklets is to reflect this diversity by giving different authors, coming from a wide range of backgrounds and disciplines, the opportunity to express their ideas and to communicate their experience on various aspects of changing theories and practices in educational planning.

Although the series has been carefully planned, no attempt has been made to avoid differences or even contradictions in the views expressed by the authors. The Institute itself does not wish to impose any official doctrine on any planner. Thus, while the views are the responsibility of the authors and may not always be shared by Unesco or the IIEP, they are believed to warrant attention in the international forum of ideas.

Since readers will vary so widely in their backgrounds, the authors have been given the difficult task of introducing their subjects from the beginning, explaining technical terms that may be commonplace to some but a mystery to others, and yet adhering to scholarly standards. This approach will have the advantage, we hope, of making the booklets optimally useful to every reader.

Preface

The decision of the Editorial Committee of the *Fundamentals of Educational Planning* to include in the series a booklet on 'Planning the School Curriculum' reflects the IIEP's growing concern with the content and quality of education as an important dimension of educational planning. The increasing importance which many countries have attached to a fundamental review of the nature of the educational process to which its younger generations are exposed has made the development of new curricula a matter of high policy priority. For educational planning, this development involves a dual challenge: first of all, it is important that those who, at the policy as well as at the administrative level, are responsible for planning the development and reform of education understand also the problems and methods involved in planning the content of the future system of education; the conventional limitation of educational planning to the projection of quantitative flows and their financial implications has unduly neglected the important planning problems involved in shaping the substance of education. At the same time, those specialists who are responsible for the actual development of new curricula are confronted with a major planning task of their own in designing, implementing, and evaluating new educational programmes; their work requires a systematic planning approach, the development of which stands to gain from the planning experience accumulated in other areas of educational planning.

I am very grateful to Arie Lewy, Associate Professor of Education at the University of Tel Aviv and, as an international authority in the field of curriculum development, a frequent collaborator of the Institute, for having undertaken the difficult task of presenting

Preface

in such limited space the major issues and methods in planning a new curriculum in such a way as to make it comprehensible and useful for everybody involved in the overall task of planning the development and reform of education.

Hans N. Weiler
Director, IIEP

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INTRODUCTION

The nature of curriculum development

A. The Meaning of Curriculum

Over the past three decades educational planners have paid much attention to the question of what should be taught in schools. More specifically, they sought adequate answers to questions of the following types: What kind of topics should be contained in various courses? What sort of instructional or study materials should be prepared for students, and by whom? What type of learning activities should be carried out by the students? In short, much concern has been devoted to decisions related to the school curriculum. Universities have introduced graduate and postgraduate courses in curriculum planning, and professional journals dealing with this topic have been launched. The volume of professional literature in this area has increased manifold during this period.

The increased interest in curriculum development appeared concomitantly with changes in the meaning of the term itself. Traditionally the term *curriculum* had been used in a variety of ways—‘to designate a programme for a given subject matter at a specific grade level, a programme for a given subject matter for the entire study cycle, or the entire programme for various subjects for the entire study cycle’ (Ochs, 1974). In most cases, however, a curriculum did not contain more than a brief list of educational objectives and contents to be taught in schools. In more recent years, however, the meaning of the term has been broadened to encompass detailed plans of student activities, a variety of study materials, suggestions for learning strategies, arrangements for putting the programme into use, etc.

This book attributes to the term *curriculum* this latter, broader definition, one more compatible with its common use in contemporary educational literature. The former narrower meaning will be referred to by us as a course or programme *syllabus*.

A team preparing a curriculum aims at producing certain types of instructional materials. Sometimes only a rough guide is produced containing suggestions for the teacher on how to prepare instructional materials best fitted to the needs of his students. More frequently the team also prepare text-books, student workbooks and enrichment learning accessories, such as supplementary reading materials for individualized learning, equipment to carry out experiments, demonstration charts and models, film loops, materials for teacher-training activities, diagnostic and evaluation instruments, corrective learning materials, simulation games, etc.

One factor which affects the amount of different items prepared by the team is the availability of resources and the urgency of completing the job of curriculum development. When dealing with the emerging educational systems of developing countries one is faced by the problem of providing curricula for newly established schools, and the need to develop inexpensive instructional materials quickly. In such systems it may be sufficient to prepare text-books and teacher's guides or else to produce educational television programmes which can easily be used in schools.

In contrast, in developed educational systems, where more resources are available for curriculum development, and where there is less urgency for preparing new curricula, it is more likely that curriculum teams will produce a great variety of items to be used in schools. Thus, curricula differ greatly from each other with regard to the amount of different items they produce.

B. Curriculum centres and curriculum projects

In many countries institutes or centres have been established to assume responsibility for preparing curricula for schools. In some countries a single institute is responsible for preparing curricula in all subject fields and for all grade levels of the school system. In other countries, this responsibility is shared by many institutes or centres each responsible for a particular section of the educational system, or of a particular segment of the school programme such as science, social studies, etc. Within the framework of a single

curriculum centre there are usually several teams working side by side each preparing a particular course of studies for a group of students of a certain type. For example, one team may work on a course of language art for children in lower elementary school classes, etc. The activity of such teams and products prepared by them will be referred to as a curriculum project. Thus, within the framework of single curriculum centre several curriculum projects are usually carried out simultaneously. Alternatively, a curriculum project may be an independent endeavour which is not affiliated to any curriculum centre, for instance, the co-operative work of a small team operating in a university department or in a research institute whose major thrust is not curriculum development.

C. Curriculum planning versus teacher autonomy

Several curriculum projects have developed highly structured educational programmes, such as the BSCS¹ (Biological Sciences Curriculum Study) or the SMSG² (School Mathematics Study Group). These curricula prescribe a well-defined sequence of learning activities to be carried out by the students. The teacher is meant to follow detailed guidelines provided by the project team, with limited freedom to deviate from these specifications, and the students are expected to learn the materials chapter by chapter as they appear in the text-books.

Two arguments have been raised against curricula of this type: firstly, it has been claimed that these are prepared for a large and heterogeneous population. Learners differ from each other in respect of abilities, values, aspirations, environmental circumstances, home background, etc. To cope with the needs of such heterogeneous populations, the curriculum writer has to work for the 'average' student, and, therefore, it is likely that a single programme will not fit the needs of learners in various settings. According to this criticism only the teacher who knows his students well can plan an adequate curriculum for the class. Secondly, it has been claimed that

1. BSCS (Biological Sciences Curriculum Study) produces courses in secondary-school biology and special materials for low-ability high-school students. It is related to the University of Colorado.
2. SMSG (School Mathematics Study Group) is located at the School of Education, Stanford University. It produces learning materials in mathematics for elementary and secondary schools.

highly structured curricula require the teacher to follow guidelines which may be incompatible with his values and preferences, thus impeding, if not fully destroying, his autonomy.

Empirical studies have shown that, even in highly structured projects, teachers exercise great freedom and adapt the existing study materials to their teaching style and preferences (Gallagher, 1970). Nevertheless, in response to these claims many less structured programmes have been produced in which teachers are required to exercise judgement in structuring the classroom programme on the basis of ideas, resource materials, bibliographical hints contained in the materials prepared by the team. Moreover, the teacher is invited to devise learning activities and to produce his own supplementary instructional materials according to his inventiveness and creative talent.

Some curriculum theorists take a more extreme position, fully denying the desirability of producing curricula by central agencies, and advocating the view that the teacher is responsible for structuring the curriculum for his class. In their view, the utilization of a centrally developed curriculum has an undesirable effect on both the teacher and the learner. According to this view, research institutes and publishing companies should prepare resource materials of different types, such as books, worksheets, audiovisual aids rather than a full curriculum. It is the teacher who should prepare the curriculum and he may use, should he find it appropriate, a variety of instructional materials produced by different teams. Accordingly, for any course the instructional materials should be drawn from a variety of sources rather than from a single curriculum package.

The principles of curriculum planning outlined in this book may be applied to both the structured and the 'open' conception of curriculum. They relate to activities of curriculum projects of any type. Nevertheless they directly deal with planning activities of teams, which are responsible for the curricula of a group of schools and produce instructional materials to be used by many teachers recurrently year after year. Although the teacher who prepares his own curriculum for his class may apply numerous principles outlined in this book for his work in the capacity of curriculum planner, it is likely that many suggestions will not fully fit his working demands.

D. Stages of curriculum planning

Curriculum development entails a series of activities: the preparation of the syllabus, the production of instructional materials and the implementation of the curriculum in the system.

Traditionally, these activities were considered to be the responsibility of different persons within the educational system. The *syllabus*, containing a list of topics to be taught in schools and some specifications of the goals of education, was usually presented by the educational authorities and policy-making bodies. *Instructional materials* were developed by educators, media specialists, or experts in the domain of the subject matter. Sometimes various items were prepared by different persons without proper co-ordination. One team prepared a text-book to cover the specification of the syllabus while another developed a series of film loops for classroom use, either to supplement the text-book or to serve as a substitute for it. It was the teacher and the learner who had to achieve co-ordination between these separately produced items of a single programme. The *implementation* of the programme was considered to be the responsibility of supervision staff.

In contemporary thinking these activities are conceived as related to each other, and therefore they constitute the responsibility of a single team. The syllabus can not be considered final until adequate instructional materials have been developed to fit its specifications and until it has been successfully implemented in the system. This means that one cannot really tell whether a new syllabus is adequate without examining the instructional materials representing its specifications. A syllabus is adequate only if it is possible to produce curriculum materials which are suitable for attaining the objectives specified in it.

If the curriculum development team fails to produce such instructional materials the syllabus is inadequate and should be changed. No matter what the reasons for such a failure, whether they result from the requirement of highly expensive equipment, lack of sufficient classroom time for dealing with a particular objective, or insufficient pre-requisite knowledge demanded of the students for learning a certain skill, the *syllabus* must be adjusted in such a way as to take into consideration the limitations of the practical realities.

As to the third focus of this process, i.e., the implementation of a new curriculum, in the traditional approach this was the rôle

of the supervisor carried out separately from the programme development personnel. In contemporary practice, however, this task is commonly delegated to the curriculum development team. This means that *they* assume responsibility for training the teachers to use the programme adequately and for monitoring the teachers' work in order to ensure successful programme implementation. Thus, curriculum development is a multi-stage process of inter-related tasks including the determination of the syllabus, the preparation of the instructional material and the implementation of the programme.

Despite the interrelatedness of the three major curriculum development tasks, for the sake of convenience and of analytical clarity they will be dealt with in separate sections of this book, in the following order: (1) planning the outline of the programme, including the preparation of the syllabus; (2) production of learning materials, including the specifications of learning activities and (3) implementation of the programme.

The major tasks carried out at these stages are presented in Table 1.

TABLE 1. Major curriculum development tasks

Stage	Activity
planning outline	selection of objectives selection of content selection of teaching-learning strategies
preparing instructional materials	creation of instructional materials organisation of materials into courses of study try-out of new materials modification on the basis of try-out results
implementation	dissemination setting of a logistic system teacher training adjustment of national examination systems co-operation with administrative bodies quality control recycling

PART ONE

Preparation of programme outline

The first decisions in the process of curriculum development are concerned with the determination of programme objectives, the selection of subject content to be learned and the selection of appropriate learning strategies. The final product of these activities is a programme outline. A detailed specification of objectives and content within a defined field of study is usually called a syllabus. A programme outline is thus broader than a syllabus. It contains both the syllabus and guidelines concerning learning strategies and learning activities to be used in the programme.

This part of the book, dealing with the preparation of a programme outline, is divided into three sections: (1) specifications of programme objectives, (2) the selection of content and (3) decisions about teaching-learning strategies.

I. Specification of objectives

A curriculum aims at introducing a series of desired changes in the student's behaviour. These are the *objectives* of the programme. Statements such as 'The student should differentiate between data relevant or irrelevant for solving an arithmetic problem' or 'The student should read for enjoyment' are objectives insofar as they suggest changes in the learner's behaviour to be realised through the utilisation of a curriculum. How are objectives determined? Since they are consciously determined goals, are they simply matters of individual or group preference? Is there any systematic way to attack the problem of which objectives to seek?

It is true that in the final analysis, the selection of objectives is a matter of choice, and therefore must be considered as representing the value judgments of those responsible for the schools. Nevertheless, the selection of curricular objectives can be facilitated by certain considerations. Clearly the relative importance of each of these considerations will vary in different curriculum projects, but some will always be important. Each curriculum development team must decide on their relevance and on their specific weight in determining curricular objectives.

A. Specification of curriculum objectives

1. *Major Considerations*

Decisions about curriculum objectives are affected by factors related to processes of contemporary life outside the school, the needs of the learner and the nature of the subject matter.

(a) Contemporary life outside the school

Since society is in a constant state of change, the curriculum planner must be ready to select educational objectives in accordance with major currents of change. It is his rôle to analyse the implications of societal changes when deciding upon a new or altered programme of study.

(i) Manpower employment patterns. Manpower employment patterns tend to change. If, over a five-year period, some ten to twenty per cent of those completing their education are entering industrial sector X rather than Y, or if there is a significant manpower switch from agriculture to industry, then clearly the types of knowledge, skills and values which will be required to prepare these people for employment will be somewhat different.

(ii) New behaviour requirements in health, welfare, politics and social activities. Social and cultural patterns of behaviour are in a state of evolution the world over. Changes should be identified and the curriculum should ensure that young people acquire the skills and attitudes needed to cope with everyday living in the society. For example, a society may be experiencing a transition from traditional to scientific medicine, one of the results being that new attitudes towards hygiene are demanded. The school then should function to equip the population with the appropriate knowledge, attitudes and personal habits.

Political changes and innovations must be dealt with in the school in order to prepare the individual to function adequately in his rôle as citizen. Changing social and economic conditions must be taken into account in the school's curriculum also.

Glaring anachronisms of curriculum, particularly in newly independent countries, are manifold: British history may be taught rather than the history of the country; lessons in French geography are given instead of instruction in the geography of the local area; biology is taught with examples of flora and fauna from Europe rather than those common to the locale. In all of these examples, the curriculum is irrelevant to the social needs of the learners.

2. The needs of the learner

In modern society there is much overlap between needs emerging from contemporary social life and those emerging from the personal

life of the learner. Adjustment to changing occupational patterns or to new health laws constitute both societal and individual needs. Nevertheless, one may identify behavioural patterns which are primarily of individual concern. Such are, for example, participation in social activities, peer-group relationships, and the development of personal traits such as endurance, tolerance, increased desire to participate in cultural activities, etc.

3. Subject matter

The contemporary organisation of knowledge within any given subject-matter constitutes another consideration for determining objectives. For instance, in the sciences, new findings, topics, structures and terms are constantly being introduced. These should be identified and considered in the process of planning a new curriculum. If the educational programme is organised according to subject matter, with unique curriculum material developed for each subject, it is first necessary to identify the Major Educational Objectives (MEO) inherent in them or which can be obtained through their study. The MEO delineate broad areas of human behaviour and should first be translated into more specific curricular objectives before they can serve specific guidelines for preparing instructional material.

As an illustration, MEO in History are given in Table 2.

TABLE 2. The major educational objectives of a history course

Cognitive objectives :

- The knowledge of important historic events.
- The acquisition of skills needed for independent study.
- The acquisition of basic concepts to describe historical phenomena and to explain them.
- The perception of historic phenomena in the context of values and ways of life of the past.
- The development of historical thinking (analytic, imaginative, synthetic).

Values :

- The judgment of historical events according to universal moral criteria.
 - The development of sympathy and tolerance toward the way of life of other nations.
 - The development of identification with the State and the People.
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ONE

4. System Consideration

The three major considerations described above directly affect decisions about curriculum objectives. The curriculum planner, however, has to take into consideration certain characteristics of the educational system, too, before decisions about objectives are made.

(a) General educational aims

In many countries general educational aims are formally stated in governmental or legislative acts, while in other countries, where such formal acts do not exist, they are implicit in the value system of the society and in its educational tradition. People determining curricular objectives should act in accordance with these general aims.

The formulation of general educational aims is of political significance. Such aims are usually stated in broad, general terms such that they secure the consensus of the great majority in the society. They serve as the basis for making decisions on how school life should be organised and what should be taught in school. However, in themselves they neither constitute nor directly determine the practical details of school life. Examples of such political aims are: education must be organised so as to 'allow equal opportunity for all children', 'be a preparation for adult life', 'increase the average level of achievement in the population', 'encourage social integration', 'make school life a more enjoyable and friendly experience', 'develop more complex thinking in children', 'increase enrolment in elementary school', 'increase the supply of high-level manpower', 'educate students for easy assimilation into the labour market', and 'combine academic studies with practical and professional preparation'.

A statement of general educational aims sometimes reflects the goals toward which the society is striving, and often presents its image of the 'ideal man' (Eden, 1975). For an illustration of this point one can look, for example, at Article 1 of the Fundamental Law of Education in the Japanese Constitution of 1947:

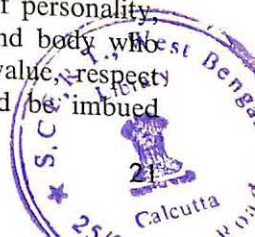
"Education should aim at the full development of personality, strive for the rearing of pupils sound in mind and body who shall love truth and justice, esteem individual value, respect labour, have a deep sense of responsibility, and be imbued

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with the independent spirit of builders of a peaceful state and society."

(b) *The school system*

A second type of consideration relevant to the selection of curricular objectives is related to the organisational features of the school system. Does the system consist of a single comprehensive type of school for the whole student population, or does it consist of schools of different types such as academic, vocational, etc.? How is the student population divided among the schools? What are the selection procedures in the schools? Are there wide regional differences between schools in respect of financial resources, general student ability level, etc.? Are there minority groups in the country who do not speak the language of the majority? Is teaching conducted in the students' mother tongue?

Answers to these questions will determine whether the curriculum objectives will be the same for all students of the system or will differ according to school type, geographical regions, etc.

The question of the language of instruction is especially important in multi-lingual countries. For example, in Nigeria a child first learns his vernacular language, then the main regional language (e.g. Hausar, Yoruba or Igbo), but the language of instruction in elementary school is English. It is important that the curriculum developers should have up-to-date knowledge about the students' proficiency in the language which serves as the medium of teaching.

5. *Bringing considerations together*

The considerations described above have not been chosen arbitrarily: they seem to have a general applicability. Each curriculum team must decide however on the weight given to these factors when making their decisions.

A schematic representation of the considerations and the relationship between them is presented in Figure 1. It can be seen that three major groups of forces should be brought together in order to prepare a *tentative list of objectives*: the needs of the learner, contemporary life outside school, and the body of knowledge related to the *subject matter*.

Contemporary life outside the school as well as the needs of the learner have an impact on setting the organisational structure of

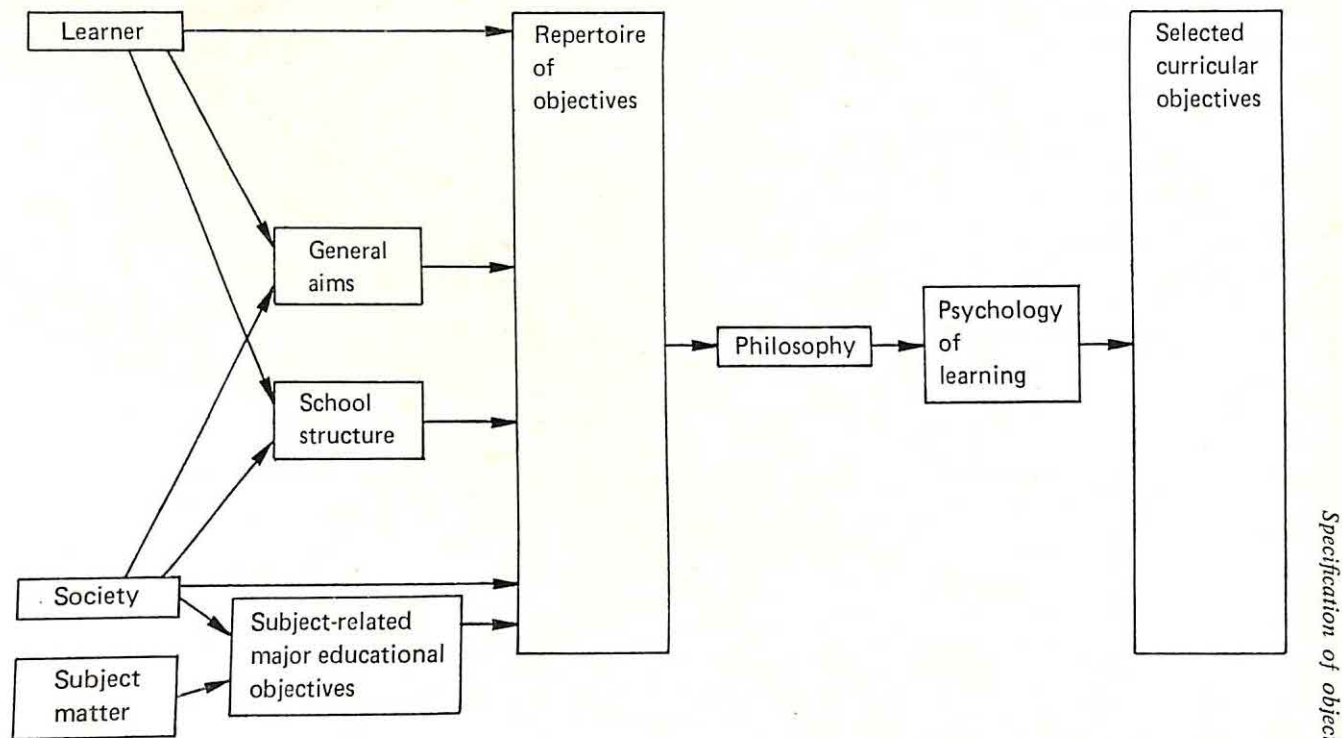


FIGURE 1. *Forces affecting selection of objectives (adapted from Tyler, 1950)*

the school and on the formulation of general educational aims, whether they are explicitly stated or not. Thus, both contemporary life and the needs of the learner indirectly affect the objectives established through the mediation of General Aims and School Organisation; additionally, as indicated by a direct arrow, they also have a direct impact.

The subject matter will generally influence the derivation of objectives through the mediation of a list of agreed-upon MEOs. It should be noted, however, that the MEOs will reflect not only the structure of the subject matter but also considerations emanating from contemporary life. This can be seen by analysing the MEOs in History (Table 2 above), many items of which reflect social concern rather than the logical structure of the subject matter.

6. Screening devices

The tentative list of objectives, derived in the way described above, contains more items than can be accommodated by a curriculum. Therefore, it should be considered as constituting a repertoire of objectives and further screening is needed in order to select those most suited for inclusion in the curriculum. The development team may utilise two types of screening criteria for producing the actual list of curricular objectives: (a) the values of society; (b) educational psychology.

(a) Values prevailing in the society

Values must be taken into consideration whenever one set of suggestions regarding objectives proves to be incompatible with others or whenever all suggestions cannot be followed because of time constraint. It then becomes necessary to choose a few consistent objectives and determine their priorities. Such decisions require value judgments based on the educational and social philosophy to which the decision-makers are committed. An adequate formulation of this philosophy will provide those values that education should seek to attain. These values serve as the criteria for every proposed objective. The curriculum builder should consider whether the objective is consistent with, in opposition to, or unrelated to these values. Some proposals will be accepted, and others rejected. Priorities will then be set among the accepted objectives.

Some of the values on which decisions might be based would be those entailed in issues such as the following:

Transfer of traditional values vs. demands of contemporary life

General education vs. specialist training

Spiritual values vs. material values

Personal satisfaction vs. social success

Value judgments can also be applied for determining priorities among classes of objectives. Thus, on the basis of value judgments one might assign higher priority to problem-solving skills than to the accumulation of factual knowledge.

(b) The psychology of learning

Educational objectives constitute statements of the results to be achieved from learning. These desired results must be appropriate to the conditions inherent in the learning process. The knowledge accumulated in the field of educational psychology can be useful in determining what goals can be attained through school instruction and what sequence of goals would be most appropriate. The psychology of learning can enable us to distinguish which behavioural changes can be expected to result from a learning process and which cannot. For instance, young children can learn to channel their physical responses in socially desirable directions, but they cannot learn to inhibit these responses altogether.

Knowledge in psychology can also assist in the evaluation of the time required to bring about certain types of change. For example, to change the basic attitudes of children requires an effort extending over several years, since it has been discovered that basic attitudes do not markedly shift after a few months of instruction. Similar data have been obtained regarding the time involved in changing ways of thinking and studying, basic habits and practices, interests and the like. Similarly, knowledge about the stages of cognitive development can determine which objectives are most likely to be attainable at which of the various age levels.

The classification of objectives

Several attempts have been made to develop a classification scheme for educational objectives. These classification schemes have served, apart from anything else, as a tool for examining the balance of

the curricular objectives of a particular programme. The most widely used classification scheme is known as the Taxonomy of Educational Objectives, in which three domains are identified: (1) the cognitive; (2) the affective and (3) the psychomotor. Those categories within each domain which frequently appear in the framework of curriculum development will be mentioned here.

1. The cognitive domain

Since, according to present teaching practice, most educational objectives are of a cognitive nature, the cognitive taxonomy has become that most widely used. The six major categories of the taxonomy are frequently clustered into two groups: lower mental functions and higher mental functions. (Bloom *et al.*, 1956).

1. *Knowledge*—the recall of information. A specific fact of a generalisation may constitute the information recalled. It should be emphasised that *knowledge* means recall only, and not application of the information in a particular situation.
2. *Comprehension*—understanding of the message of a communication and the ability to explain or summarise it.
3. *Application*—the ability to use a principle, rule or method in a concrete situation.
4. *Analysis*—the ability to break down a communication into its constituent elements and to clarify its content.
5. *Synthesis*—the ability to combine elements so as to form a whole. This category contains the notion of creativity which has in recent years been strongly emphasised as a worthwhile educational objective.
6. *Evaluation*—judging the value of material and methods for a given purpose.

2. The affective domain

Affective objectives emphasise feelings, emotions and the degree of acceptance or rejection of a given phenomenon. These objectives occupy limited space in the more traditional sets of curricular objectives, but their importance is now becoming more widely recognised. Attitudes, values and interests are types of affective behaviours. (Krathwohl *et al.*, 1964).

Only the first three categories of this domain are mentioned here, because only they appear frequently in the formally stated lists of curricular objectives.

1. *Receiving* (attending)—This category is concerned with being aware of the existence of certain phenomena and revealing willingness to tolerate a stimulus. Thus, for example, being aware of the existence of classical music and being able to differentiate it from music of other types constitutes an example of *receiving*.

2. *Responding*—This is more than merely being aware of a phenomenon. It means active participation, such as going to a concert of classical music or purposefully listening to a classical record.

3. *Valuing*—Behaviour categorised at this level is stable and consistent. Thus a sustained interest in classical music, repeated visits to concerts, etc. constitute signs of valuing classical music. De Landsheere (1975) refers to this category as 'taking initiative'.

3. *The psychomotor domain*

Several objectives related to the acquisition of practical skills and habits appear in a number of curriculum areas, for example, practical and laboratory work in science subjects; work experience as a part of extended general education; handicrafts; psychomotor components of reading and writing, etc. A classification scheme of psychomotor skills has been developed by Dave (1969). The scheme is based on the concept of co-ordination between psychic and muscular actions and between different muscular actions performed by various parts of the body. The five categories of the scheme are listed below:

1. *Imitation*—Activities which do not require muscular co-ordination.

2. *Manipulation*—Following directions, acting according to instructions.

3. *Precision*—The ability to increase speed of action, and to introduce modifications according to specific needs of a particular situation.

4. *Articulation*—Co-ordination of series of acts by establishing appropriate sequence, developing efficiency to perform a number of related acts simultaneously and sequentially.

5. *Naturalization*—Routinizing the act to such an extent that it results in automatic and spontaneous response.

Educational objectives appearing in various subjects usually pertain to the higher-level categories of this scheme.

Should educational objectives be stated?

Most curriculum theory experts emphasise the need to start the development of a programme by specifying a behaviourally-defined set of objectives. They stress that this is necessary also to enable the assessment of a programme's effectiveness in obtaining its goals. There are however opponents who believe that not always is it advisable or even possible to state objectives in advance (Eisner 1967). Eisner summarised his arguments as follows:

1. The dynamic and complex process of instruction yields outcomes far too numerous to be specified in behavioural terms in advance.
2. In certain subject matters, such as in the fine arts, novel or creative responses are desired, and therefore the particular behaviours to be specified cannot easily be identified.
3. Not all outcomes of curriculum are amenable to measurement.
4. Educational objectives need not precede the selection and organisation of content.

A strong position against explicitly stating educational objectives characterizes several recently developed curricula. Their major concern is the shaping of adequate learning activities which are aimed at enhancing students' mental, emotional and physical growth. The developers of these programmes believe that one first has to identify a topic which provides opportunities for a variety of interesting learning experiences, and then to stimulate students to answer questions, to solve problems, to exercise creative imagination and to participate in worthwhile learning activities. The teacher's rôle is to structure the learning environment and to ensure conditions which will increase the students' interest and involvement in work. Thus, rather than specifying the desired outcomes of an educational programme the curriculum worker in such cases attempts to suggest a variety of experiences, activities, processes, negotiation patterns, etc., which can beneficially affect student's growth.

These arguments suggest an alternative way of curriculum development which has proved to be efficient in instances where highly talented and well trained teachers have assumed responsibility for implementing the programme. But even if one denies the desirability of explicitly stating educational objectives it seems desirable that

curriculum workers be cognizant of the notion of behaviourally defined educational objectives and of the taxonomic schemes for their classification. Such knowledge is necessary to ensure a proper balance of suggested learning activities. The curriculum writer as well as the teacher should keep in mind that learning activities should enhance acquisition of values, growth in higher mental skills and should not over-concentrate on memorizing facts. Such a distinction implies reliance on the taxonomic scheme, even if the curriculum writer is not aware of it.

II. Selection of content

Behavioural objectives may differ with regard to their generality. For example, the objective 'The student should be able to describe the details of an event which he has observed' is very broad in scope and may equally apply to biological, sociological or psychological phenomena. On the other hand, a statement such as 'The student should enjoy listening to classical music' applies to a more narrowly defined set of situations, although it also includes a variety of behaviours. Classical music comprises thousands of musical pieces, hundreds of composers and a variety of different styles. To develop a curriculum which will lead toward the attainment of this objective, one cannot teach all existing pieces of classical music. One must select certain works to be taught in the school. The totality of classical musical pieces constitutes the universe from which the curriculum developers have to select but a few.

The organised bodies of accumulated knowledge, information and artistic heritage constitute curricula content universes. One may speak about the content of physics referring to terms, facts, rules, principles, methods, etc. which make up the field of this subject matter. The term 'curricular content' denotes not only bits and pieces organised in a systematic way to make up subject fields but also events and phenomena which cut across the boundaries of subjects. For example, one may study transportation systems, pollution, etc. these being considered as curricular content.

During the process of curriculum development, decisions should be made about the specific content to be included in the educational programme. How should this selection be accomplished? What principles should guide the curriculum developer in making the

proper decisions? These questions emerge with regard to both the curricula for inter-disciplinary subjects and the curricula for specific disciplines. With respect to the first type of subject the relevance of the material to the learner often constitutes a satisfactory selection criterion. However, for discipline-centred curricula there is a need to establish more systematic criteria for content selection. Thus, for example, in a physics curriculum one should deal with the most important components of the discipline, and selection of content cannot be made solely on the basis of students' interest.

1. The structure of discipline

The concept 'structure of discipline' has frequently been suggested as a device for selecting curriculum content. What is meant by the structure of disciplines? Schwab (1964) refers to it as covering three distinct but related sets of problems.

1. The way in which accumulated knowledge is organised according to disciplines or the way discrimination is made between areas of investigation. Thus, for example, 'the structure of the cell' is studied by biologists and the 'structure of the atom' by physicists.
2. The set of basic concepts used to describe a variety of phenomena within the boundaries of a discipline. The knowledge which has been accumulated in the discipline is formulated in terms of these concepts. For instance, knowledge of atomic structure is formulated and communicated in terms of the concept of particles and waves. Such conceptual structures prevail in sciences and in many arts.
3. The set of basic methods and rules used within the framework of the discipline for providing evidence, in other words, the methods of enquiry unique for that discipline. Since each discipline in essence seeks different types of knowledge, it follows that they may also employ different methodologies and have different criteria for verification.

Schwab's ideas have had a tremendous impact on the process of selecting curricular content. According to his view, the curriculum developer has to identify the structural elements of a given discipline and to select content related to and fully covering all of these elements. As a result of Schwab's writings, systematic attempts have been made in a variety of disciplines to determine what constitutes their structural elements.

2. Basic themes or key concepts

An alternative device for choosing content may be the listing of *basic themes* within each particular discipline or subject matter. The substantive structures as defined by Schwab explain a large body of knowledge in a given discipline. However, in many disciplines, especially in the arts, it may be difficult to define substantive structures, and all that can be said is that certain ideas are more important than others in that they illuminate or give significance to more lower-level concepts. The more important concepts may be looked upon as guiding ideas that best explain the knowledge within the discipline. In some disciplines it is impossible to identify more than the most basic themes (Wheeler, 1971). Several examples of this latter type can be given. For instance a series of key themes in social studies was developed by the Syracuse University Curriculum Centre; some of them are listed below (Beyer, 1971).

Substantive concepts

- Sovereignty, Conflict, Industrialization, Urbanization, Power, Habitat, Social Change, Social Control.

Value concepts

- Dignity of Man, Empathy, Loyalty, Freedom, Equality.

Aspects of method

- Historical method and point of view, Causation, Observation, Objectivity, Scepticism, Evidence.

A list of basic themes for literature programmes has been prepared by the Carnegie Institute of Technology. These themes reflect man's universal concerns: (a) his concern with the society in which he lives, (b) love, (c) reality and illusion, (d) heroism, (e) human weakness, and (f) the search for wisdom (Wheeler, 1971).

3. The exemplar approach

A different approach for selecting curricular content was developed by the German educator Martin Wagenschein (1970). Wagenschein emphasised the need to select only a few curriculum content elements and have the students study them thoroughly rather than having them study a large number of issues and themes superficially. He produced a graphic representation of the different approaches for selecting content, which is presented in Figure 2.

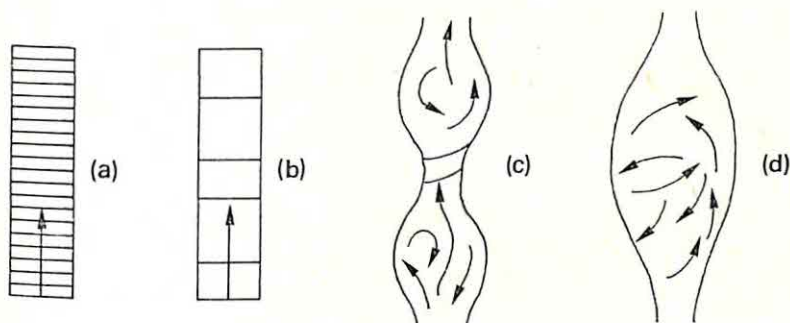


FIGURE 2. *Ways of content selection*

Diagram (a) represents linear progress in a given subject in which a great many topics and themes are superficially treated in the curriculum. This approach can hardly be recommended; the student can easily be overloaded with isolated facts and ideas, being unable to distinguish between those that are important and those that are peripheral. Diagram (b), too, represents linear progress, but the number of content units is greatly reduced. The students learn fewer facts, but probably learn them more thoroughly. However, even in this design there is no special emphasis on topics according to relative importance. In the design depicted in Diagram (c) certain content units are surveyed briefly in the class while other units are strongly emphasised; this approach enables a meaningful structuring of topics and can result in meaningful learning. The recommended approach is illustrated in Diagram (d), representing the selection of a single content unit which constitutes an example of a whole series of phenomena. Hence the term 'exemplar' approach. For example, using this approach in a history course, the topic of de-colonisation would be treated by the thorough study of a single developing country. All aspects of the phenomena such as the relationship between the colonising agency and the native population, the fight for independence, national unity, multi-linguistic society, industrialisation, etc. could be covered by aid of this single example. The advantage of concentrating on one example is that it enables the students to become fully acquainted with a situation: the learner deals with concrete issues and not with abstract outlines.

4. *Pragmatic criteria for selecting content*

No matter whether content selection is based essentially on the identification of structural elements, basic themes, or characteristic exemplars, one should also apply certain supplementary pragmatic criteria.

Basis for further education. Dave (1973) emphasises the principles of selecting contents in such a manner that they provide a wide basis and choice for further learning both in school and outside the school.

Relevance to contemporary issues. During the process of content selection, preference should be given to topics and issues that are important to the society. For example, in a particular course on applied biology a unit was included to discuss the means of controlling insects which damage agricultural crops. To teach the appropriate principles and methods, the author of the programme could have used any example; however, he decided to dwell on the specific crop which played a major rôle in the nation's economy.

Cultural heritage. Curriculum should include instruction about the cultural heritage of the community. It could be that a certain historical event, which in itself is not of any great importance, nor of great interest to the scholar, constitutes part of the national or local 'folklore' in that names of places or persons associated with it are frequently mentioned in literature, art, public speeches, etc. Events of this type should be included in a systematic history course.

Opportunity for multiple learning activities. It is preferable to include topics in a curriculum which lend themselves to various kinds of classroom and individual activities, such as experimentation and picture analysis, rather than those which lead to verbal activity only. Multi-sensory activity increases the motivation of the learner and enables him to rely on the type of cues that best fits his aptitudes.

The objective content matrix

A convenient model for representing programme planning is the objective content matrix. In such a matrix one dimension contains

a list of the desired behaviours, or the behavioural objectives of the curriculum, and the other dimension contains the content components of the programme. The list of objectives serves as a guide to the curriculum developer in focussing on preparation of certain types of educational materials.

An example of such a behaviour-content matrix is presented in Table 3.

TABLE 3. Selected behavioural objectives from a health programme¹

Objectives	Content	
	Nutrition	Diseases
Recognition of terms	The student should be familiar with the terms: vitamin, oxidation, protein	The student should be familiar with the terms: virus, immunity, epidemic
Identification of specific facts	The student should know the characteristics of healthy food The student should identify sources of information about food	The student should know indices of communicable diseases The student should know the ways of spreading diseases The student should know the diseases caused by lack of vitamin
Application of principles to novel situations	The student should predict the consequences of enzyme changes on the digestive system	The student should give appropriate reasons for treatments
Evaluation of health information	The student should judge the quality of foods on the basis of food labels The student should criticise food advertisements	The student should distinguish between adequate and inadequate evidence of disease

1. Adapted from Thorndike and Hagen, 1969

In the matrix presented here the vertical dimension contains abbreviated forms of objectives, such as 'The student should recognize terms in the field of Health Studies', etc., and the horizontal dimension contains content units such as 'nutrition' etc. The cells of the matrix contain specific objectives corresponding to the appropriate major headings of both the horizontal and vertical dimensions.

This does not imply that the preparation of the objectives-contents matrix necessarily precedes decisions about learning activities. Frequently, only on the basis of analyzing learning activities appearing in the final version of the programme will such a matrix be completed.

Distinction should be made between the rôles of the objectives-contents matrix in highly structured curricula versus its rôle in weakly structured ones. In highly structured curricula it constitutes an inventory of desired outcomes for all students using the programme, because students are meant to follow a certain predetermined pathway through the whole series of learning activities included in the programme. Conversely, in weakly structured programmes the objectives-contents matrix is an inventory, from which the teacher selects those which best fit the needs of this students. Therefore the actual classroom experiences will consist only of a selected portion of the full matrix.

III. Teaching-learning strategies

In traditional educational theory, teaching method or strategy was considered to be a problem detached from the process of curriculum development. Curriculum developers were expected to develop instructional materials, which would be transmitted to the students through the particular teaching-learning strategy selected by the teacher. The selection of a teaching approach was considered a decision to be made subsequent to the completion of curriculum production rather than being a part of the process. This approach still prevails to some extent in contemporary practice. In many cases the teacher may apply various teaching strategies to a given set of curricular materials. Nevertheless, in most cases the specific form of the instructional materials suits one teaching mode rather than another.

Decisions concerning the selection of teaching-learning strategies have become a part of the curriculum development process and it is felt that they should precede production of the instructional materials. The type of student activities suggested by the curriculum, the style for transmitting information, selection or omission of specific facts, the sequencing of activities, the quantity of material and the extent to which it is structured, etc. are all strongly affected by the educational philosophy of the curriculum developers and by the recommended teaching-learning strategies.

The curriculum developer may decide to utilise a single instructional strategy for an entire programme. For instance, programmed instruction might be the only mode of instruction used. However, a curriculum does not necessarily have to utilise a single technique. A curriculum may employ a variety of learning strategies, either as

alternative modes for learning certain skills or as sequential activities for learning different sections of the same programme. This second, eclectic approach is not only permissible but very frequently recommended. There are two basic reasons for recommending the eclectic selection of teaching-learning strategies. First of all, a particular strategy may be effective for transmitting certain types of knowledge but less suitable for others. Secondly, some students may learn more easily with one particular strategy, while other students may profit more from another one. General teaching-learning strategies are described below.

1. Expository teaching

Expository teaching is the straightforward transmission of information to students by means of printed material or lectures. In educational practice, both means are often simultaneously used with the same group of students. For example, a textbook might be used which is supplemented by explanation of the material in class by the teacher.

Over the centuries expository teaching has been the most commonly used method in the classroom. This method of using both printed material and lecturing has several advantages:

Economy. A large group of students may attend a lecture. The lecture concentrates on what has to be learned and if it is not interrupted by irrelevant questions or remarks, a relatively large amount of material can be covered in a short time. Students absent from the lecture can learn the material from the textbook, while those who have attended the lecture may reinforce their exposure to the material by reading the textbook.

Flexibility. Though the material printed in the textbook is fixed, the teacher may be flexible and spontaneous in his lecture. He can explain difficult concepts and can relate the material to current events or happenings. The teacher usually allows the students to pose questions about issues not fully understood, and by including a number of probing questions in his lecture, he can get a feel for whether the students have understood his explanations. On the basis of such information, he will be able to adapt his lecture to the needs of the students.

Despite the advantage of economy and flexibility, this mode of teaching also has several disadvantages:

Passive reception. Research in the field of learning has proved that active participation in the learning process as experienced by the student in manipulative work, writing and speaking yields better results than passive exposure to information through reading or listening.

Self-restraint. Students listening to a lecture are required to sit quietly at their desks. Such self-restraint over a prolonged period may create a tense climate in the class and therefore educational psychologists and teaching experts recommend restricting the extent and the frequency of its use. Expository teaching strategy may be efficiently employed for some parts of an educational programme, such as in the explanation or demonstration of basic facts and concepts, but it is seen as being less efficient in teaching higher mental functions such as comprehension, application, etc.

2. Inquiry learning

In inquiry learning, the students have to do more than passively absorb information to be repeated at the teacher's request. Instead, the student has to organise information in a meaningful way so as to provide solutions to particular problems or point out the structural relationship between various elements.

An example of an inquiry activity taken from a textbook for elementary school students will illustrate the nature of this technique (Beyer, 1971):

Most of us may know something about Africans, but we probably do not know much about the Asaute. Here is a list of words commonly spoken by Asaute today. Examine these words and their meanings. What can you say about the Asaute?

abankesee	— castle	duva	— market
adua	— bean	futuro	— dust
afuo	— farm	kobere	— copper
agrohemmaa	— queen	nkoron	— mine

agya	— uncle	nwunb	— humid
edom	— army	teaseenam	— car
etoc	— tax	wesee	— dry
okra	— soul		

Photographs about the Asaute also appear in the students' work-book. As Beyer points out, the object of this exercise is not the simple accumulation of facts but rather to teach the student to make inferences and develop criteria for testing the correctness of his inferences.

Beyer defines inquiry learning as a strategy in which the student has to identify the problem to be resolved, propose possible solutions, test these possible solutions against the evidence, draw the appropriate conclusions warranted by the testing, apply these conclusions to new data, and arrive at generalisations. This is a somewhat broad definition of the inquiry strategy. An inquiry-type learning experience usually contains only certain of the elements appearing in Beyer's definition.

Several expressions have been coined to denote variations of inquiry learning. These include 'inductive learning', 'discovery learning', 'guided discovery learning', etc. While these terms are frequently used in the educational literature, there are no commonly accepted definitions which clearly differentiate between them. Curriculum experts, however, have differentiated between various levels of inquiry strategies as illustrated in Table 4.

TABLE 4. Levels of inquiry¹

Level	Problem	Method of solution	Solution
1	+	+	—
2	+	—	—
3	—	—	—

1. The sign plus means 'given to the student', the sign minus means not given to the student

In the simplest of inquiry assignments, the problem and the method for its solution are provided to the student. In a higher-level inquiry assignment, only the problem is given and the student has to select

for himself an adequate method for arriving at a solution. Finally, at the highest level, the student has to define the problem which is the subject of his inquiry.

Bruner (1962) identifies four major advantages for using this strategy:

1. *Intellectual potency*—if the student learns a principle through the method of inquiry (in Bruner's terms the word 'discovery' appears), he is more likely to use it for solving other problems.
2. *Motivation*—students derive more satisfaction from learning of this type than from expository learning, and therefore their motivation to learn increases.
3. The students learn the *rules for solving problems*.
4. Knowledge acquired by this method is *more easily remembered* than that which is learned through expository methods.

In recent times, the inquiry method has become a frequently used learning strategy.

3. *Small group teaching*

Another method involves the division of the class into small groups each working independently. In such a situation the teacher is not the transmitter of knowledge but rather the co-ordinator of activities and a guide to information and its processing. In a small group setting each student can assume an active rôle. He may participate in planning the learning task as well as in carrying it out. Small group teaching can be carried out in different ways: each group can be assigned the same task to perform, but it is also possible for a different assignment be given to each one. (Sharan, 1976).

A broad problem area can be covered, with each group working on a segment of the problem. Thus, through joint effort, small group work may serve as a basis for a common class activity. For example, an experiment can be planned in which the assignment of each group constitutes a replication of a given treatment. It is then possible to summarise the findings of all of the groups and to propose a solution for a given problem. Or perhaps the class is studying a particular historical period; one group may study the relevant political issues, another group will look at the economic issues, and a third group will investigate the cultural factors. A common class discussion of work presented by the various small groups may shed light on different aspects of the same phenomenon.

Small group teaching requires the preparation of adequate curriculum material which can be used by the groups.

4. Individualised learning

Learning takes place within the individual. Its outcomes can be measured only by behavioural changes taking place in the individual. Despite this fact, in most school situations the teacher focuses his attention on the group rather than on the individual.

Many educational psychologists have recommended restructuring the learning context in school so that each student works individually. The particular learning tasks and the rate of progress should be determined separately for each individual. Such individualised instruction can be better tailored to the ability level and interests of each student.

Two different types of individualised learning have been introduced in schools. First of all, there are the highly structured individual learning kits. The learning tasks are assigned to each individual on the basis of diagnostic tests; in this way the student receives a learning task which fits his particular level of knowledge. The transition from one learning task to another is monitored by task-related tests. If the test results prove that the learner has mastered a given task, a new more complex task will be assigned; if he fails, he receives additional training material related to the same task (Lindvall, Cox and Bolvin, 1970).

The second type of individualised learning, often called independent learning, is entirely unstructured. The student selects a certain problem and works on it for a while until he has satisfactorily completed his work. Individualised learning of this type aims, among other things, at enhancing the intellectual independence of the learner and his ability to make decisions.

5. Learning for mastery

A successfully applied technique for monitoring learning is the strategy of *mastery learning*. It is based on the assumption that the great majority of students are capable of mastering most of the learning objectives included in educational programmes, but that the amount of time needed for mastering a certain task and the

type of cues which optimise learning results may vary from student to student (Bloom, 1968; Block, 1971).

In general this teaching-learning strategy is characterised by the following major features. Instruction is carried out in regular classroom situations and the calendar time for progression from one topic to the next is the same for all students in the class. Upon completion of each learning unit, formative or diagnostic tests are administered in order to determine whether or not a student has achieved mastery. For each learning task included in the programme there is a full list of necessary pre-requisites. A well constructed diagnostic test will point out the specific areas in which an individual needs supplementary learning; students who have difficulty mastering a particular topic receive additional time and assistance so that they, too, may reach a mastery level. They may be aided through a variety of corrective devices, such as individual tutoring, programmed instruction, repetition of previously learned material, etc.

6. Games

Games are usually employed as supplements to teaching strategies of other types.

Coleman (1967) describes several advantages of game-type instruction. First of all it is intrinsically rewarding; the student wants to play the game well and therefore will willingly learn anything to increase his chances for success. Secondly, a game often constitutes a simplified representation of a complex real-life situation; it abstracts selected elements from real life and thus enables the learner to master manipulation of these selected elements one by one. Thirdly, a game implies active participation and therefore it is likely to be more efficient than passive-receptive instruction. The following types of game strategies are frequently used in education.

Rôle-playing. Rôle play is useful in teaching the student to understand the opinions, views and motives of other persons. In rôle-playing, the learner may be asked to defend the opinion or act in the rôle of some other person. In the educational context, a typical rôle-playing assignment might be to assume the rôle of a parent facing a conflict situation with his child, or to act out the views and opinions of a historical or literary character.

According to Mead (1934), the child can develop a 'self' image only after going through a process of learning to view himself through the eyes of others. Rôle-playing can help the child to develop such an understanding.

Simulation. A student may be presented with a hypothetical problem, which resembles a real-life situation, and be asked to work out a solution by applying certain rules. In a simulation situation the learner often tries out a variety of tentative solutions, comparing their relative advantages, before finally recommending a particular solution. For example, in the course of a social studies lesson, a class might draw up a plan for a city. Relevant geographical, demographic, and economic data are presented to them and they are expected to produce a city plan in which allocation of land is made for residential use, industry, recreation, commercial centres, transportation lines, etc.

Academic games. Sometimes facts and principles can be learned as part of a game. While playing the game, the student can acquire skills which are included in the learning objectives of the programme.

Academic games are usually based on competition between players, in which each player strives to win the game through skilful application of the rules of the game.

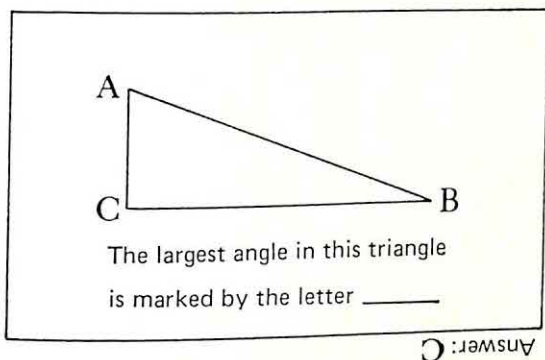
An example of an academic game is the Legislative Game. In this game a group of 6 to 13 persons constitutes a legislative body. A legislative session is simulated in which eight issues are to be put to the vote. Each legislator has to vote in a way which satisfies his constituents and secures his re-election. To obtain this goal, he may enter into coalition with other legislators.

It should be noted that the major learning outcome in such a game is the proper application of the rule rather than accidental or associative learning of a series of facts.

7. Programmed instruction

In programmed instruction the learning materials are divided into small units which are called frames or steps. Each frame contains a single assignment requiring a sentence or a picture to be com-

pleted or a question to be answered. An example of such a frame is presented below:



The advantages of this strategy are summarised by Stolurow (1969): First of all, attention is focussed on a small quantity of material at a time. Secondly, an active response to each question is required which facilitates learning. Thirdly, immediate knowledge of results (feedback) after each response enables the student to correct his errors. Finally, such a strategy permits each student to proceed at his own pace.

In order to prepare programmed materials, it is first necessary to define learning objectives and then to divide them into a set of sequential tasks. The sequence of the tasks can be based on the hierarchical structure of the learning objectives (Gagne and Briggs, 1974).

From the organisational point of view, programmed instructional material may be presented in either a linear or a branched form. In the linear form each learner studies all frames; in the branched form, however, each assignment is determined by the response given to the previous frame. If his response is correct he proceeds with a task of a different or more advanced type; if his response is wrong, he must study additional frames dealing with the same task or its prerequisites.

Programmed instructional materials may be prepared in the form of printed matter or be administered through the use of teaching machines or computers. The advantage of using teaching machines to administer programmed instructional material is that it prevents the student from looking for the solution to a problem without trying

to provide the answer by himself. Also, since a teaching machine or a computer programme can provide 'individualised feedback' the programme may be branched more easily.

PART TWO

The creation of instructional materials

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Decisions concerning programme objectives and content, which are frequently published as programme syllabi, make up the first steps in the development of a curriculum. The complete curriculum plan, in addition to the specification of objectives and content, also includes information about the types of learning strategies to be used.

Many educational authorities satisfy themselves with the formulation of syllabi and leave the task of the development of instructional materials to private initiative. However, in contemporary education there has been an increasing tendency to have teams creating syllabi also work on the production of instructional materials (Hawes, 1972). The syllabus may serve as the starting-point for such work, but generally it is considered to be only a tentative working document which is subject to change.

This section of the book, devoted to the creation of curriculum materials, has been divided into two chapters: the first is concerned with instructional materials and their organisation, and the second deals with the try-out and evaluation of new materials.

IV. Instructional materials and their organization

One of the final products of each curriculum project is the production of several types of instructional materials. If the teacher develops his own curriculum, he is likely to utilise products easily available in his environment for the preparation of the learning material. If the curriculum is developed by a central institute for a large population, items of various types will be assembled in a package or kit for easy dissemination. What does a curriculum kit contain? What are the working procedures for developing the different items contained in the kit? What are the principles for organising the various elements of the programme into a coherent set of learning stimuli? These are the major questions discussed in this chapter.

A. Components of the programme kit

The most simple form of instructional material produced by the curriculum team is a teachers' guide, composed of suggestions and instructions for the teacher on what to do in the classroom. This is an indispensable item because it is necessary to inform the teachers of the programme's goals so that they can make use of the programme adequately. Generally, the programme kit will also contain individual study materials in the form of textbooks, worksheets and supplementary materials. In many cases, classroom materials, such as demonstration charts, slides and equipment, are also included. Finally, a programme may also have components which are deposited in regional centres to be borrowed by schools for classroom use.

1. Students' individual learning material

Most curriculum kits contain some instructional materials to be distributed among the students in the class, such as a textbook or workbook. However, as already indicated, it is not absolutely necessary to include individual materials in the curriculum kit. In many educational systems preference is given to a more economical approach, with the teacher's guide containing instructions on how to activate students, parents and the teachers themselves for producing learning materials. Such an approach may have advantages not only of an economic nature, but also of a pedagogical and psychological nature, since materials produced in such a way may better fit the needs of the particular students. In addition, it is likely that materials of this type will be more acceptable to all concerned than that which is sent to them by an external organization or commercial firm.

Occasionally a wide variety of individual learning assignments are organised into a single kit which is given to the teacher, who distributes them to his students in such a way that each individual or small group receives a different assignment. Such an arrangement enables the teacher to better handle individual needs.

Usually, however, all students in the class have an identical set of instructional materials. The textbook is, even today, probably the most commonly used learning material. Nevertheless, in recent years textbooks have undergone revision and no longer contain only expository material intended for memorization, but also suggestions for individual or group activities and diagnostics devices by which the learner can assess his own progress. An attempt is made to stimulate students to do independent work of the inquiry type. Often they are required to make use of primary sources, dictionaries, encyclopedias and maps. They are frequently asked to collect data and to process it. In other words, the textbook presents the students with a problem, the solution of which requires some degree of research.

Another feature of modern textbooks is that both visual and manipulative stimuli, which generally take the form of charts, diagrams, pictures and maps are introduced in addition to the usual verbal stimuli. Often the textbook advises the students on how to construct instruments or manipulate materials.

A modern-day textbook is no longer a self-contained book of

knowledge, but rather one item among many required by the student in the process of learning.

2. The teacher's guide

The teacher's guide aims at helping the teacher to monitor the programme. Usually the guide alone is not sufficient preparation for the teacher and special training sessions are necessary. However, even in such instances, the teacher's guide is a necessary accessory, and probably the most important component of the programme kit.

The major purpose of the teacher's guide is to provide detailed instructions for teaching each particular section of a programme. In addition it may contain background and enrichment materials as well as suggestions for supplementary activity.

Guidelines for programme usage

The teacher's guide should contain information about the rationale which provided the basis for developing the programme, the pedagogical principles involved, the major educational objectives of the overall programme and the specific behavioural objectives of each programme section. Thus a general introductory chapter should be included in the guide, dealing with the programme as a whole, followed by specific sections which are devoted to each major unit. The teacher's guide should present several alternative ways of dealing with a particular lesson, so that the teacher can select the way best suited to the needs of his class and his personality.

Background materials

Often, in view of the advancement of science and the development of new instructional approaches, the teacher's knowledge of a topic taught in school must be enriched. Therefore, background materials must be available to the teachers for programmes in new mathematics, modern physics or other topics not previously studied systematically by the teacher. A bibliographical guide to relevant materials would be very useful.

Supplementary teaching materials

The teacher may wish to give additional assignments to the gifted students in his class, or may look for remedial materials for those having difficulty. For this reason, most teachers would welcome a

section in the teacher's guide devoted to ideas for supplementary teaching.

3. Diagnostic instruments

Diagnostic instruments included in a programme kit, to be administered either by the teacher or the student himself, may serve the purposes of placement and monitoring.

Placement.

Diagnostic instruments can be used for determining whether the learner has mastered all the pre-requisites needed for studying a new curriculum unit. Should the diagnostic results show that a student is not ready for new materials, remedial learning activities can be provided.

Monitoring.

Upon completion of a sub-unit, the student can be given a formative test to determine whether he has mastered the topic or whether he requires more time for mastery.

4. Classroom equipment

Classroom equipment may contain three types of materials: demonstration materials, resource materials and group materials.

Demonstration materials.

Examples of items used for demonstration purposes are: posters, maps, slides, three-dimensional models, coins, plants, butterflies, insects, stuffed birds or small animals and chemical and geological materials. The teacher explains their characteristics or uses them to illustrate a principle. Their major rôle is to serve as visual cues for recalling information.

Resource material.

Reference books, documents and data constitute resource materials. The students are requested to organise and analyse information derived from such sources. If a new curriculum requires the utilisation of reference books or data which are not usually available in school libraries, such materials should constitute a component of the programme kit.

Group materials.

Certain types of instructional material are designed for group use only and therefore do not constitute a part of the individual equipment. For example, an educational game to be played by at least 3-5 students will be a part of the classroom equipment.

5. Audio-visual equipment

A motion picture, videotape or phonograph records may constitute a part of classroom or school equipment, though such materials are often stored in a regional resource centre from which schools may borrow for classroom use.

In this section only audio-visual programmes which constitute a part of a programme kit will be dealt with. Such programmes may serve different rôles.

Starting-point for discussion.

A controversial issue or conflict situation may be presented to the students either in the form of a radio play or as a televised programme. The dramatic events presented in such a sketch can serve to sensitise the student to the existence of conflicting values.

Explanation.

A televised programme may be suitable for demonstration purposes. The capability of the television camera to revert from a wide-angle shot to a close-up picture enables the viewer to observe an object and its component parts with a high level of clarity and precision. Also the possibilities of presentation excel in flexibility. For instance, objects may be superimposed on others or, by dividing the screen, parallel processes may be observed simultaneously. In addition, the speed of a process may be altered to facilitate demonstration.

Illustration.

Audio-visual equipment may be used to provide information of a type which would be difficult to present by other means. For example, it can take the viewer to distant parts of the world and present authentic pictures of strange natural phenomena, remote places, life patterns in different cultures, etc. Motion pictures commemorating major events of recent decades are available and through skilful cutting and editing it becomes possible to present

the student with authentic pictures not only of the present but also of past events.

Meeting the expert.

Through television or radio programmes, the learner can 'meet' face to face with the most outstanding experts or leading personalities of social and intellectual life.

Integrating audio-visual materials with classroom instruction.

Audio-visual aids included in curriculum kits are designed to be integrated with classroom instruction. To facilitate such integration the curriculum team may develop working sheets related to particular audio-visual materials, which contain preparatory exercises for viewing or listening, and observation or summary sheets to be filled out after the programme is over.

B. Organisation of learning materials

The organisation of instructional materials involves two different processes. First of all the material must be assembled for the purpose of production; this activity entails decisions about the specific form which the materials are to take and the ordering of the study units. Secondly, the sequence in which various materials are to be used in class must be determined; to do this requires answers to the following questions: How should various sub-sections or parts of study materials be related to each other? What connections should be established between different aspects of a programme?

With respect to the format of the materials, two major arrangements are common: the linear and the modular. If the students are expected to study all units contained in a programme according to a prescribed sequence, the materials are arranged in a linear fashion. On the other hand, in a modular arrangement the teacher decides which portions of the programme are to be used and determines their order.

Concerning the sequencing of curriculum materials in the classroom, several principles have been suggested by curriculum experts. All of them, however, relate to very specific aspects of this complex problem. The curriculum developer who faces the problem of how to guide teachers in the organisation of classroom activities, as well as the teacher who has to make decisions about sequencing, receives

only partial answers from theories and principles, and on the whole has to rely on intuition and experience. Some of the organisational principles and ideas suggested for use in curriculum development are explained below:

Linear versus modular curricula.

In a linear organisational arrangement, materials are presented in a textbook, or other such form, in the same sequence in which they are to be taught in class. Most textbooks are arranged in such a manner. Linear curricula are highly structured and later study units usually require information and skills taught at an earlier stage.

In a modular arrangement, the sequence in which study units are presented can be selected by the teacher, who may decide to choose only certain items and omit others. This type of curriculum allows for greater flexibility and leaves more decisions to the teacher than does the linear type. In the modular curriculum the teacher can select units and determine their order in a way which best fits the needs of his class. Modular units can serve to supplement a linearly structured curriculum. The major disadvantage of the modular arrangement, however, is that since it has to contain a great variety of different materials from which the teacher has to make a selection, it is generally more costly in terms of both programme development and production of the required materials.

The general framework of a course.

Three major approaches prevail concerning the organisation of learning materials into courses of study; these are the subject matter, core curriculum and activity approaches. Several other approaches are mentioned in the educational literature, but most are virtually synonymous with these three major approaches. In the *activity approach*, the student's interest prescribes the organisation of the instructional materials. The teacher and the student together frame the course, and the curriculum developer does not affect its general structure.

The most widespread way in which a curriculum is organised is around *subject matter*. During the past three decades most educational programmes have been structured according to subject matters. The classical humanities and science disciplines have each been taught as separate courses.

Recently, however, there has been an increasing trend to integrate

several related disciplines into a single course. For instance, integrated science courses have been developed which cover all branches of science such as biology, chemistry and physics within the framework of a single course. Also courses have been developed in social studies, linking together topics from history, geography, civics, economics, sociology, anthropology, etc. Courses may also be organised around broad social problems or central themes and the relevant ideas from a variety of disciplines. Some examples of such themes are: birth control, space exploration, pollution, sea farming and urban development. Programmes of this type are frequently called core curricula (Good and Merkel, 1973).

To a large extent the organisation of the curriculum, whether it be according to separate subject matters, integrated subjects or core issues, has been determined already at the stage in which the curriculum outline is produced. Decisions concerning the type of organisation will determine the contents of the programme. However, since this is an organisational problem, it has been dealt with in this section.

Learning hierarchies.

A learning hierarchy is the arrangement of learning tasks into a pattern which clearly indicates the lower-level skills and abilities needed for successful handling of more complex tasks. In this pattern of organisation one starts with the learning objective, which is broken down into component abilities called pre-requisite skills. A pre-requisite skill is obviously simpler than the super-ordinate task, and must be mastered before the 'super-ordinate' task can be performed. An example of a learning hierarchy is presented in Figure 3 (overleaf).¹

The task analysed in Figure 3 appears in a kindergarten programme: the children are to learn how to divide a set of objects into two halves. The skills designated in the second line are the pre-requisites for performing this task. The child cannot divide a set into two halves if he does not know that two equal subsets are halves of the total, and if he cannot construct two equal subsets from a set of objects. The third and the fourth lines in the figure indicate the pre-requisites for the lower-order tasks.

1. Adapted from Gagne and Briggs, 1974.

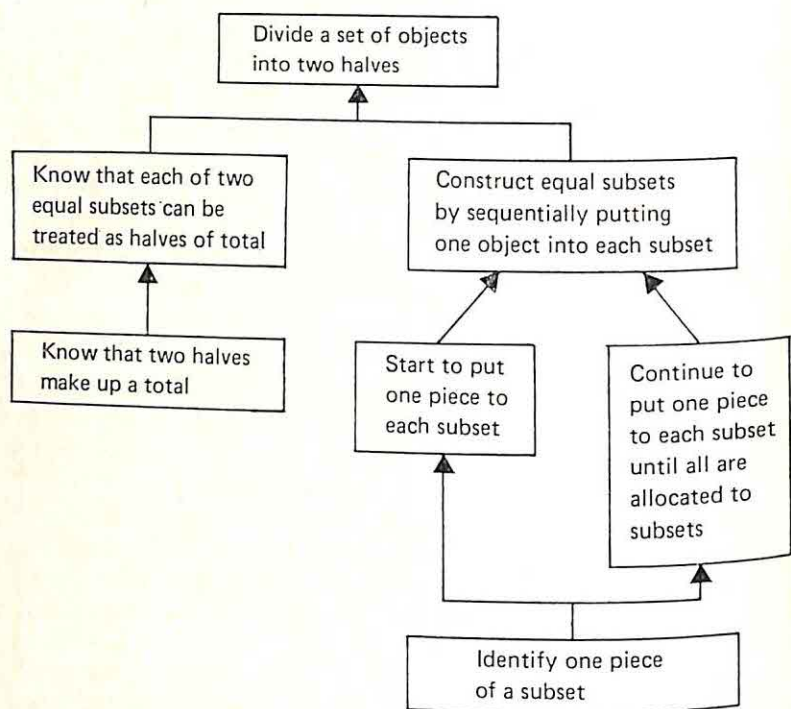


FIGURE 3. *Learning hierarchy for a task in elementary mathematics*

The construction of learning hierarchies facilitates decisions concerning the sequence of learning activities in a programme. However, the development of learning hierarchies is a difficult task and the field of curriculum development has not yet reached the level required to confidently base curriculum planning upon the utilisation of this method.

Balance.

The concept of balance in this context refers to adequate proportioning and sequencing of different types of learning activities. Variety reduces boredom and enhances student interest.

Vertical and horizontal arrangement.

The way in which different learning activities are related to each other has an impact on the efficiency of the programme. As illustrated in Table 5, it is possible to arrange learning materials both

vertically and horizontally. Vertical arrangement refers to the sequencing of materials or a single programme in time, whereas horizontal arrangement refers to the co-ordination of the learning materials of various programmes for the same group of students.

TABLE 5. Vertical and horizontal arrangement

		Horizontal →		
Vertical ↓		Grade 4 - subject 1	Grade 4 - subject 2	Grade 4 - subject 3
		Grade 5 - subject 1	Grade 5 - subject 2	Grade 5 - subject 3
		Grade 6 - subject 1	Grade 6 - subject 2	Grade 6 - subject 3
		Grade 7 - subject 1	Grade 7 - subject 2	Grade 7 - subject 3

Vertical arrangement. The use of a learning hierarchy is one way in which the material in a curriculum programme may be vertically organised. In Western educational tradition two different approaches for vertical organisation of a discipline have become widespread. In some school systems one-year courses which cover a particular subject are commonly found; for example, the BSCS biology programme treats all the biological information intended to be taught in high school in a one-year programme. The advantage of this approach is that it allows the student to concentrate on a particular subject and to study it in concentrated manner. On the other hand, the disadvantage of the approach is that for several years the student does *not* study a subject, and thus he may gradually forget what he has learned. The other approach which is commonly found in the schools is to teach a certain subject over several years and to devote to it fewer teaching periods per week.

A basic question related to this problem is the number of times a student is required to study a particular topic throughout his school years. If during twelve years of schooling students must study national history several times, does this mean that they are repeating the same course each time? The answer is definitely *no*. Since at various stages of their mental development students are capable of dealing with the same subject at different levels of depth, each repetition involves also learning new aspects of the subject. Two approaches are widespread concerning the repeated study of the same subject. One is called the *cyclical* approach, which means that the same subjects are repeatedly taught in cycles of 3-4 years, each time in greater depth and scope. The second approach is called

the *spiral* approach; according to this approach certain basic concepts, ideas or topics are repeatedly introduced into the curriculum without a systematic repetition of the entire field.

Horizontal arrangement. During a school year, the student may study 8-10 different subjects. Usually, the instructional materials for each one of these programmes have been prepared by different teams, which may lead to an undesirable compartmentalisation of the learning programme. A student may study different subjects without being able to discover the relationship between them. The co-ordination of the materials in various disciplines, which are to be learned by a group of students in one school year, is referred to as horizontal arrangement. Horizontal co-ordination is less problematic in core curriculum frameworks than in the subject-matter frameworks. In a core curriculum ideas rooted in different disciplines are horizontally co-ordinated. However, if a student's weekly educational programme is divided up into 8-10 subjects, then the question of horizontal arrangement or co-ordination becomes extremely important. In many cases attempts have been made to link the topics and themes appearing in several subjects; for example, instruction has been given on a certain time period simultaneously in history, art and literature courses. Generally these attempts have yielded only partial success. It is extremely difficult to plan such co-ordination and in many cases such an arrangement severely interferes with the systematic treatment of a subject. It seems that a more promising approach would be to view the development of certain basic intellectual skills and attitudes as the threads which integrate the study of various subjects. Thus, for example, the skills of extrapolation, discrimination, concept formation and critical analysis may be fostered at the same time within the framework of various subjects. Utilisation of such integrative threads should not be left to chance, but rather should be planned in advance by those who are responsible for curriculum development.

C. The curriculum team

If the producer of the new instructional materials is the classroom teacher, he will probably work alone or in a small team with several other teachers in the same school or in neighbouring schools. In

curriculum centres, however, there is a need to establish proper division of labour and co-ordination between various tasks in order to ensure the production of adequate curricula.

In most curriculum centres a curriculum committee and a curriculum team co-operate in the production of a new programme. The curriculum committee consists of leading experts, such as university professors, top educational administrators and representatives of various interest groups, and is in charge of making general policy decisions with respect to the objectives or contents of the programme.

The actual work of producing instructional material is carried out by a team. Who are the members of such a team and what are their qualifications for participation in such teams? Curriculum teams are composed of people of different types. Generally, the most successful programme writers are experienced teachers, since they are acquainted with the type of language appropriate for a particular group of children and the kind of activity which will arouse their interest. They are also familiar with the activities and skills of the average teacher, and therefore can produce materials which have a greater likelihood of being used successfully in the school. Such a team is guided in its work by different types of experts. For example, specialists in a particular subject field will help in the selection of course topics and the 'product designer' will help in giving an appropriate form and 'finish' to all items prepared.

The production of instructional materials is primarily an art, and though systematic study may help to improve the quality of the product, there is a need for ingenuity and creativity in accomplishing a good job in this field.

V. Formative evaluation of curriculum materials

A. Evaluation during the process of programme development

Instructional materials, even if developed by highly experienced and competent teams, need to be tried out in an actual classroom situation before being released for general dissemination in an educational system. On the basis of empirical data collected during the process of programme development, the curriculum team is able to improve the programme by changing or omitting certain portions, by suggesting additional learning activities, or by changing the sequence of the already existing learning activities. Evaluation activities should be performed throughout the whole process of programme development and under no circumstances should they be postponed until the programme is completed and disseminated throughout the entire system.

The gathering of evidence while parts of a programme are still being developed is termed *formative evaluation*. Formative evaluation may be applied to particular components of a programme at the very beginning of programme development activities. As soon as certain components are developed, it is advisable to examine them empirically in order to determine their efficiency in obtaining the desired objectives. Evaluation of this type is referred to as *prototype evaluation*. When the curriculum team has developed the major portions of the programme, it becomes possible to assemble them into a tentative kit and try them out on a few classes. Often, at the time of such *preliminary try-outs* various minor components of the programme will still be missing and instructional materials at this stage will appear in a very preliminary form. For instance,

the textbook takes the form of mimeographed sheets and pictorial material may not yet be collated with the text. On the basis of evidence gathered at such a preliminary try-out setting, the instructional materials will be modified and a new edition of the kit will be produced. This edition, which will already contain all components of the programme in a form approximating its finally intended one, may then be tested in a group of classes which have been selected to represent the target population of the programme. Thus, formative evaluation of a programme generally consists of three consecutive stages: prototype evaluation, a preliminary try-out and a field trial.

1. *Prototype evaluation.*

Decisions are made about the types of learning activities which will be included in the programme at the very beginning of programme development. For example, for a sixth-grade chemistry course, it was decided that the students would use a precision scale to weigh various objects. The development team was not sure if children at that age would be able to use such an instrument easily and therefore they conducted a small-scale evaluation study; on the basis of the data collected, they found that children aged 11 are capable of using a precision scale, but that they work with the scales very slowly and have to devote too much attention to their operation. It was concluded that the use of a precision scale would distract the children's attention from other tasks they have to perform. On the basis of such evidence the team decided to change the nature of the activities planned for the course, eliminating the use of a precision scale.

Evaluation activity of this type generally deals with a category, or type of activity. Thus, for example, to test whether students of a certain group have difficulty in using a microscope, one may conduct a prototype evaluation study. Such a study can be performed even before the instructional material is ready for classroom use. If evidence is gathered showing that students can use the microscope, then the curriculum writer may suggest a series of exercises which involve the utilisation of the microscope. However, to test whether students are able to perform a *particular* learning activity which requires, among other things, the utilisation of a microscope, one has to wait till the preliminary try-out of the actual study materials to be carried out in the classes.

2. The preliminary try-out.

The preliminary try-out of curriculum materials is performed when the first version of the programme is ready for use in the classroom. On the basis of prior prototype studies, the developing team will have a good idea as to whether the programme in its totality will be likely to succeed; nevertheless, there will still be uncertainty concerning the adequacy of certain details of the programme. The curriculum team will want to find answers to the following questions: What specific learning activities are difficult for the learner? What portions of the programme should be presented in a simpler form? Where are more exercises and repetitions needed? What can be eliminated from the programme without much loss? These types of questions have to be answered on the basis of empirical try-outs of the new curriculum materials.

Ideally, the curriculum team includes at least one member who is knowledgeable and competent in the field of evaluation. This person must be aware of the overall aims of the programme and should help in carrying out the try-out. To avoid the danger of novel features of the programme being refuted by adverse critics before they have had a chance of being thoroughly examined in a large sample of students, it is recommended that evaluation at this stage be performed by a person who is a sympathetic co-worker of the team. External evaluation by persons who did not participate in the programme development should be postponed to the field trial stage.

The preliminary try-out is conducted on a small sample made up of 4-6 classes. The classes are selected on the basis of the teachers' willingness to co-operate with the curriculum team. During the whole try-out process the curriculum team maintains close contact with the classes, discusses the problems related to utilisation of the new programme with the teachers, observes the classes and collects data of different types. The fact that only a small number of classes participate in the try-out enables the curriculum team to observe the process of teaching the programme in the classroom very closely. As a result of analysing the data and collating the results obtained, the curriculum team revises the programme and prepares a penultimate version which then will be submitted to a field trial.

It should be noted that evaluation conducted at this stage does not rely on objective measures only. On the contrary, the evaluators seek a wide variety of evidence and are interested in gathering the

opinions and reactions of various persons. The mode of evaluation common at this stage has been termed 'responsive' (Stake, 1973) and illuminative (Parlett, 1974), suggesting the utilisation of unstructured types of data such as that which can be furnished by experts, teachers and parents. Experience has shown that both unstructured and structured data can provide evidence for the improvement of a programme.

An important characteristic of the try-out is that it can be conducted before all of the elements of the programme are fully completed. Thus, since the curriculum team maintains close contact with the teachers of try-out classes, it is possible to conduct the try-out even before the teachers' guide is prepared. Moreover, very often the teachers' guide is prepared simultaneously with the preliminary try-out of the material and with the co-operation of the try-out teachers.

The fact that the try-out is performed on a small number of classes facilitates the speedy production of the instructional materials. At this stage, it may be sufficient to reproduce the textbook in mimeographed form and to use provisional hand-made equipment. Therefore, the 'preliminary try-out' of the material itself does not necessarily prolong the time needed for the completion of the programme. Since giving the final touches to the material and its preparation for print are time-consuming, one can minimise the additional calendar time needed for a preliminary try-out by proper scheduling.

3. The field trial.

The penultimate version of the programme is submitted to a field trial on a representative sample of the target population. Usually 30-50 classes are selected, depending upon the available resources and upon the homogeneity of the target population. In the case of a highly heterogeneous target population, in which regional, linguistic or ethnic differences are substantial, a stratified sample should be selected. This may require a larger number of participants than a simple random sample.

In the field trial the curriculum team cannot maintain close contact with all of the classes in the sample, and it is often necessary for them to utilise long-distance means of communication. For this reason, they cannot rely on their personal impressions and experiences to judge the successes or failures of the programme, and it

becomes necessary for them to develop formal instruments, such as multiple choice tests and questionnaires, for the purpose of data collection.

The field trial is designed to examine the efficiency of the programme. At this stage, the programme is almost in its final form and the conditions under which it is tested are more representative of those in the entire system than those of the preliminary try-out. For example, the teachers have been randomly selected rather than having volunteered, and the type of communication between them and the developers more closely reflects the situation which will exist in the entire system.

If the preliminary try-out has been carried out carefully, the field trial will not result in major modifications of the programme, but rather in suggestions concerning the required conditions for the programme's use. Suggestions may be made concerning teacher training and physical facilities. Information will be obtained regarding the time needed for the course, the kinds of pre-requisites necessary, and the types of student most likely to benefit from the new programme.

A schematic representation of the three evaluation stages is presented in Table 6. Differences between them with respect to the programme materials concerned, the sample size and their function are indicated.

TABLE 6. Formative evaluation stages and their characteristics

Evaluation stage	Programme materials	Sample size	Rôle
Prototype	Typical components	1-2 classes	selection of activities
Preliminary try-out	Provisional version of most components	4-6 classes	modification of programme
Field trial	Penultimate version of all components	30-50 classes	determination of preconditions for programme use

B. Types of data used in formative evaluation

The types of data used within the context of formative evaluation can be classified into three major categories: judgmental, observational and performance.

1. Judgmental data.

The data provided from the opinions of the experts, teachers, parents, supervisors and students who have worked with the new curriculum material are called judgmental data. This type of data is gathered through the use of questionnaires and interviews. One advantage of judgmental data is that they can be gathered with a minimum of difficulty and time. They can be gathered and analysed very quickly, and thus they can reveal both the strengths and the weaknesses of the new programme in due time to permit the curriculum developers to use the evidence without resulting in delay of development activities. A major source of difficulty with this type of data is that they are not free of the particular biases and attitudinal sets of the respondents which may result in distorted responses; for this reason it is advisable not to rely solely on subjective opinions but to gather additional types of evidence also. Judgmental data can be used to answer the following types of questions:

QUESTIONS ADDRESSED TO CURRICULUM AND SUBJECT MATTER EXPERTS

- What relationship exists between the objectives, contents and learning strategies contained in the programme?
- How accurate are the curriculum materials?
- How well are the various components of the curriculum related to each other?
- Does the sequencing of learning activities appear to be appropriate from the point of view of the subject matter as well as from the point of view of the learner?

QUESTIONS ADDRESSED TO TEACHERS AND SUPERVISORS

- Are the materials feasible and practical for use by the teachers?
- Do the teachers need retraining?
- Are the costs of the materials likely to be too great?
- Are explanations and illustrations contained in the teachers' guide and instructional materials clear?
- Is the difficulty level appropriate for the target population?

- What specific aspects are too difficult or too easy?
- How relevant are these materials to the students' interests and needs?
- What desirable or undesirable changes are likely to take place in the students other than those specified in the curriculum plan?

QUESTIONS ADDRESSED TO LEARNERS

- Were the explanations clear?
- Were the materials too easy or too difficult?
- Were the materials interesting?

2. *Observational data.*

Observational data are collected through the systematic observation of teaching/learning situations in the classroom or elsewhere. Trained or untrained observers record their observations either in a free manner, or according to structured and pre-determined categories.

Observational data are used to determine how the curriculum materials and procedures are actually employed in the classroom and whether they fit the criteria or specifications designated by the curriculum team. For example, information about the following items might be sought through observational techniques:

- The kind of questions raised by teachers;
- The rôles students assume;
- The types of materials and equipment which teachers and students are expected to use;
- The way students are grouped in the class;
- The types of interactions (including questions and answers);
- Misinterpretations of the learning material.

Observation is carried out also to provide data about the learners' reactions to the instructional materials. Notes might be taken about the following things:

- Attention paid to the teacher's explanations;
- Involvement in performing required tasks;
- Interest in the study materials;
- Difficulties encountered in comprehending the materials or performing assignments.

3. Performance data.

This third type of data provides information regarding the central problem of curriculum development, that is, what is learned by the students when the curriculum materials and methods are used properly. While this may be determined in part through both observation of students and student reports, in most curriculum centres structured or semi-structured tests are used to determine what students can do and how they feel about what they have been required to do in the programme.

Generally tests of this sort are developed after careful analysis of both the learning objectives for the programme and the actual curriculum materials.

One advantage of this type of data is that they provide the most direct evidence about the effectiveness of the curriculum materials and methods, and as a result they can serve to support or negate the conclusions drawn from the other types of data which were collected at an earlier stage.

For formative evaluation, the use of *criterion-referenced tests* is recommended. Each item on such a test represents a well-defined and specific behavioural objective. Unlike the commonly used standardised objective test, which tends to rank students according to their score on a particular test, the *criterion-referenced test* enables one to determine if a student has mastered particular objectives or not. Since the curriculum developer is interested in knowing what the weak points of the programme are and what portions of the programme require further revision, he has to obtain separate information related to each particular programme objective; it is not sufficient for him to know how an individual student performs on a test in comparison to other students of the same group, and therefore his purposes are better served by a criterion-referenced test.

4. Integrating information from various sources.

An overall picture of the different rôles served by the three major data sources which have just been discussed is presented in Table 7. The vertical dimension of the table contains certain types of information, which may be useful for the curriculum writer in assessing merits and shortcomings of the programme. The horizontal dimension of the table lists the data types which can be used in the context of evaluating a particular feature of the programme.

TABLE 7. Types of formative evaluation data

Types of information	Judgmental data			Observation data	Performance data
	Curriculum and subject experts	Teachers and supervisors	Students		
Attainment of objectives	x	x			
Accuracy	x				
Organisation	x	x			
Feasibility					
cost	x	x			
Clarity	x	x	x	x	x
Difficulty	x	x	x	x	x
Interest	x	x	x	x	
Adequate usage		x		x	
Unexpected changes	x	x		x	

Although performance data might provide evidence about whether or not the students are learning, rarely by themselves do they indicate *why*. In order to know why a new programme is successful or what must be changed to improve it curriculum teams must turn to observational and *judgmental data*. Thus, under most conditions, try-out and revision of new curriculum materials and methods must depend on the combined information obtained from the three kinds of data—*judgmental, observational, performance*.

PART THREE

Implementation of a new programme

Although a new programme might be excellent, its proper implementation in the school system is not automatically guaranteed. Good innovative programmes have failed in the past because of flaws in implementation. The reason for this is that school systems tend to be conservative; even if they officially subscribe to innovations, they may be unprepared or unable to carry them out adequately. Therefore, implementation needs careful planning and monitoring.

The manner in which programme implementation is carried out varies from system to system. In many school systems it is the responsibility of the curriculum development team, while in others it is delegated to the supervisory staff or some other branch of school administration. No matter who is responsible for implementation, certain preparatory and monitoring actions have to be taken in all systems.

VI. Setting the stage for implementation

Quite frequently the implementation of a programme is a much more complex process than its development. While development of a programme is usually conducted in a single development centre by a relatively small team, implementation may require contact with hundreds of schools, thousands of teachers and tens of thousands of students. This chapter specifies the major aspects of the dissemination of a new programme and describes the various organizational alternatives for carrying out this task.

A. Aspects of programme dissemination

Programme implementation requires the establishment of an adequate logistic network to ensure the timely delivery of essential supplies and equipment to all schools, and the necessary contact with those branches of the educational system whose activity directly affects programme implementation, such as teacher-training institutes, administrative and supervisory bodies and examination boards.

1. Logistics

Irregularities in the delivery of necessary supplies to the schools may threaten the proper implementation of the programme. If the textbook is printed only a few weeks before the beginning of a school year, it may be difficult to ensure its arrival on time. Where modular units are used, care should be taken that all units reach the schools. In many curriculum projects, inadequate supply of the teacher's guide causes serious problems; this occurs often when bookshops refuse to keep the guides in stock because of the low demand for them.

A more serious problem is the regular supply of school equipment and arrangements for its maintenance. For example, in a biology programme it was necessary to supply a certain type of fish to all schools, and schools which did not receive the fish were not able to use the programme. If certain mechanical devices are required for use in science laboratories, care should be taken not only for the delivery of the items, but also for a sufficient amount of spare parts to replace those which become damaged.

2. In-service teacher training

Most new programmes require additional training of the teachers. Care should be taken to motivate teachers to participate in in-service activities and to ensure the adequate level of such training activities. A comprehensive in-service training course should provide the teacher with the following:

- (a) knowledge of the material, including background on the subject matter, experience in working through the activities for themselves, information about how the materials were developed;
- (b) understanding of the objectives and appreciation of the relationship between learning experiences and objectives;
- (c) understanding of the teacher's rôle in using the programme, of the principles of class organisation and the kind of interactions intended;
- (d) ability to monitor the progress of the pupils;
- (e) opportunity for continuing self-development.

3. Initial training

Establishing good contact with teacher-training institutes is another task related to implementation which may facilitate the work of retraining. One way to secure the co-operation of teacher-training institutes is to involve them in decisions related to programme development and try-out. Indeed, such involvement may contribute not only to the implementation of the new programme, but also to improvement of the quality of teacher training in general by increasing its relevance to the contemporary rôle of the teacher.

4. Administrative bodies

Dissemination of a new programme by means of direct contact with classroom teachers may result in friction between the teachers and their superordinates. A school principal or an inspector can hardly

be enthusiastic toward a programme about which he knows very little. There is no need to emphasize that without the support of the school's administrators the chances for successful programme implementation are very low. Therefore, representatives of the administrative bodies should be involved in or consulted about the curriculum work from the beginning. An effort should be made to ensure that principals and school inspectors are kept informed of decisions being made, so that they do not feel as if the developers are usurping part of their rôle.

5. *The rôle of national examinations*

Standardised examinations which are intended to be put to nationwide use are written at one stage or another in most education systems.

Such examinations may serve a variety of purposes. They may be required before the granting of graduation diplomas, or as a selective measure to determine which students are qualified to proceed to a higher educational stage. It is well known that the form and content of such examinations can exert a profound influence upon what is taught in the schools. Examinations can be good servants of an education system; they should never become its masters. In other words, the *curriculum* should dictate the content and objectives of examinations, never the other way around. It is unsound educational practice to allow an examination to determine what students should learn and, therefore, what they will be taught. It may indeed be necessary to seek reform in the examination system of a given country, in order to allow new educational objectives to be achieved.

B. Organisational alternatives

The organisational structure of the dissemination network may be either centralised or decentralised. These two types of organisational structures, as well as various patterns of contact with teachers, will be described below.

1. *The centre-periphery model of dissemination*

Dissemination of a curriculum project can be conducted from a single curriculum centre. The activities for the most part will be

directed by the curriculum development team itself. Within the curriculum centre a horizontal division will be established of such tasks as logistics, teacher training, contact with administrative bodies, programme updating and evaluation. If the school system contains a large number of schools it will be necessary to establish regional dissemination offices, and contact with the schools will be through these regional offices. The internal organization of each regional office will reflect that which exists in the curriculum centre, i.e. the regional offices will provide all services for the schools.

Such an arrangement constitutes a hierarchical structure which is characterised by stable and simple lines of authority. The national centre co-ordinates the activities of the regional offices and each regional office, in turn, may establish district offices responsible for a certain number of schools. The extent to which freedom is given to the regional and the district offices and their initiative is encouraged will vary according to circumstances. The danger of such a structure is that peripheral areas may get out of control, unnoticed by the centre.

2. The proliferation of centres

Programme dissemination may be delegated completely to the regional offices. No co-ordination or control is left to a central office. Such an arrangement is advisable whenever there exist wide regional differences within a single school system, and also when well trained experts or professional workers are available in each region to aid in the implementation of the programme. Regional offices may be more suited for taking care of local needs and may exert better control over peripheral areas than a single national curriculum centre.

3. Contact with teachers

Regardless of the type of organisational structure, those people in charge of implementation need to maintain close contact with the teachers who are using the programme in their classrooms. Contact can be maintained in several ways:

1. Through annual training seminars for all teachers just beginning to use the new programme. The duration of such seminars will vary according to local needs and circumstances.
2. Through periodic meetings with all teachers (usually every few weeks) to discuss problems which arise.

3. Through a liaison person who is assigned to each school to help teachers with their work.
4. Through a hierarchical structure of contact; for example, the regional or central office might train a group of 'master' teachers, who in turn are sent out to train other classroom teachers in small groups.
5. Through any combination of the arrangements described above.

VII. Monitoring and recycling

An educational programme which has been introduced into a system requires continuous monitoring. It is not enough to disseminate the programme and to set the stage for its acceptance in the schools. Without taking care to update it, to provide supplementary materials, or to maintain control of the quality of its implementation, a programme may deteriorate and lose its viability.

A. Updating and supplementing

Curriculum materials should be continually updated and supplemented. The task of the curriculum team does not end with publication of the curriculum package; new problems may emerge after it is in use, and it is the job of the curriculum team to cope with such problems. Teachers should be informed about any new developments in the subject matter which are relevant to topics included in the programme. Not only in the field of science are there rapid changes which must not be overlooked by an educational programme, but also in social studies and humanities. A new performance of a Shakespearian play may be of interest to the teacher of literature, just as new experiences in space research are important for the science teacher.

Many curriculum projects publish newsletters which contain the teacher reactions to various portions of a new programme. In addition such newsletters also contain supplementary materials for the programme, such as new exercises or new learning activities which may be added to the original ones.

Continuous care should be taken to improve the equipment used

in programme implementation. Teacher-training programmes should also be modified on the basis of accumulated experience.

Finally, new ideas should be developed to help the teachers evaluate achievement in their classes. This is important, since repeated use of the same tests allows the teachers and students to become too familiar with the particular test questions, thus reducing their validity.

Often curricula also require some adjustment in line with the characteristics of the particular region. This is true for biology programmes, for example, where the variation in flora and fauna may require slightly different examples and exercises. Also, in national history and literature programmes attention should be given to events related to local traditions, events and heroes. Field trips planned by the regional offices constitute indispensable components of centrally developed curricula.

B. Quality control

When a new curriculum or educational programme is implemented, the general expectation is that its effectiveness will increase with the passage of time. Teachers gain experience and adjust to the new programme or teaching method. Students also learn what is expected of them in a new curriculum.

However, in some cases, an educational programme which had seemed effective during the try-out and field trial stages proves inadequate at a later stage. An educational programme is said to have 'deteriorated' when it loses its effectiveness. Sometimes deterioration occurs only in particular schools or only in some sub-groups of students. For example, a curriculum may become inadequate for students in rural schools, while it continues to operate well for students in urban schools. This is illustrated in Figure 4. While students in urban schools continue to maintain the same level of achievement year after year, the data of figure 4 indicate that in rural schools year after year the achievement level is decreasing.

Deterioration has also taken place when only some objectives are met and others are not. For example, it may be found that in respect of the knowledge and comprehension expectations of a programme learning outcomes continue to be satisfactory, while with regard to the higher mental processes, such as application, analysis

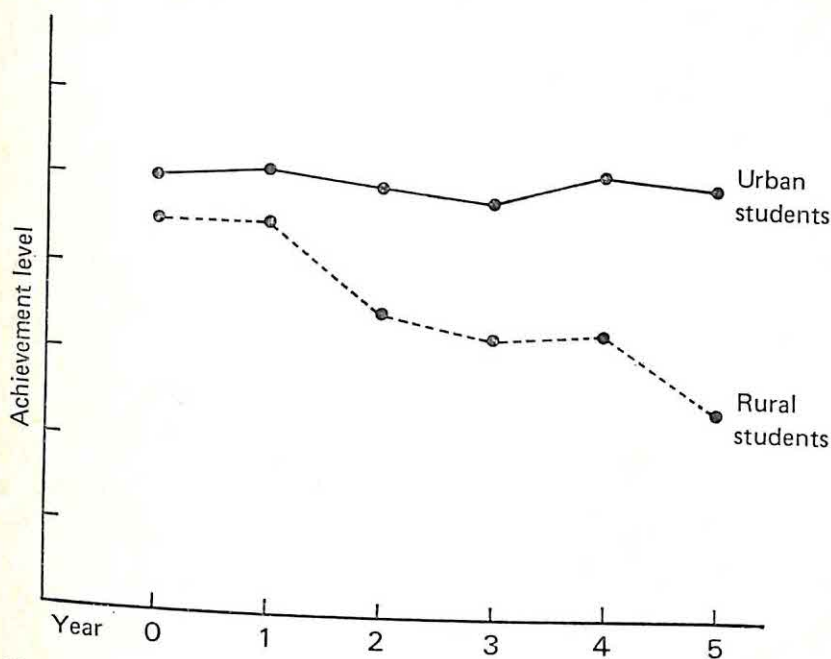


FIGURE 4. Differential deterioration in sub-populations

and synthesis, the programme is no longer effective. A hypothetical example is shown in Figure 5.

Sometimes deterioration occurs for some parts of a programme, although the curriculum continues to work well with some students, teachers and schools, or concerning the attainment of some educational objectives. The term *differential deterioration* is used to describe such partial or differential decrease in the effectiveness of a particular curriculum, method or procedure.

Quality control should be conducted so as to find out whether or not a particular programme continues to be effective in attaining the specific educational objectives for which it is intended. When significant deterioration is noticed, it is important to determine what can be done to restore effectiveness. Careful data collection and analysis may help to identify the source of deterioration. Sometimes the cause may be due to some teachers' failure to use the new method correctly in the intended way. In other cases, deterioration may be caused by some built-in but hidden characteristics of the

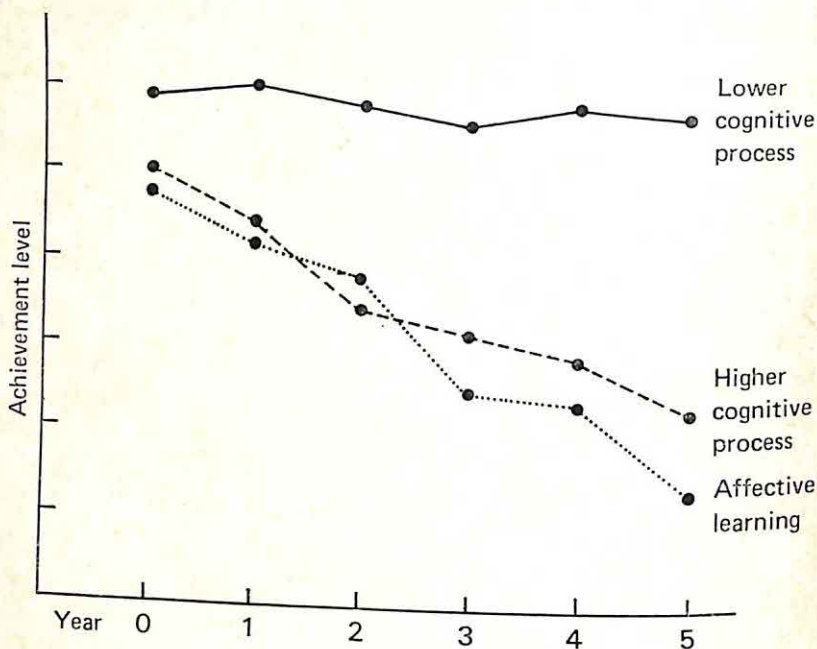


FIGURE 5. Differential deterioration in parts of the programme

educational programme itself. Without knowledge of the reasons for deterioration, it is very difficult to work out solutions to remedy it.

C. Recycling

Adequacy of a curriculum is a time-bound concept. What may be adequate at one time may become inadequate later. Changing conditions may call for a change in the foci of a programme. Contemporary developments in the subject matter may determine a shift of emphasis from old concepts to new ones. Changes in social conditions and values and developments in educational technology may demand programmes different from those which are available at present and which have functioned well in the past. To keep abreast with changing demands a periodic re-examination of curricula is necessary.

Piecemeal alteration or complete redesigning

Changing a curriculum can be accomplished in two different ways: The changes may be performed either gradually in a step-by-step manner or by complete renewal.

A step-by-step alteration possesses many advantages. It is relatively easy to perform and does not require new planning, since it utilizes the existing material. Improvement is attempted by eliminating flaws and by updating and supplementing it. Such changes are, in fact, results of continuous formative evaluation activities. Another advantage of this piecemeal approach is that it does not require major changes and thus rarely does it encounter opposition.

At the same time, however, the advantages of this approach constitute its disadvantages. For the most part such changes touch only peripheral issues, while the basic philosophy of the programme remains unchanged. The existing framework imposes restrictions on the creativity of the developer to produce something entirely new.

An example from the field of technology may illustrate this point. In the 19th century people were very much concerned with the deficiencies of the kerosene lamps used for lighting. The light was not strong enough, it produced smoke and dirt, and it frequently caused fires. If scientists had tried to solve these problems by the 'piecemeal alterations' approach we might today have an improved version of the kerosene lamp. But the solution to the problem came in an entirely different way: electric lighting replaced the kerosene lamp. The change came through a complete re-designing of the existing system.

By the same token, in the field of curriculum production it is often justifiable to relinquish an existing programme in its entirety and to try to create something new. Indeed the curriculum projects of the 1950s often disregarded existing programmes entirely. In recent times one often encounters the demand for a 'second generation' set of new programmes, based on a greater integration of subject matter and use of mass media. One cannot tell whether these new programmes, if and after being developed, will eliminate the existing ones, or be added to the existing repertoire of educational programmes from which teachers may select those which best suit the students' need.

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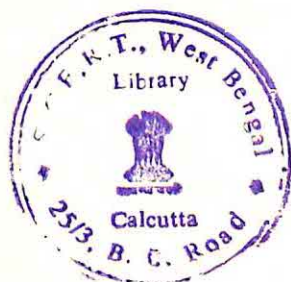
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